Breckenridge, Minnesota Interior Drainage Floodplain Mapping with Focus on Area South of the Roundhouse

24 June 2015

Predicted Ponding Elevation in Area 12

- Feasibility Study
  - 100yr = 959.8 (29)=959.8+0.8=960.6(88)
- LSER Study
  - 100yr= 961.1(88)
  - This is an increase of 0.5 feet

FEMA Floodplain Mapping

- We **expect** FEMA to map the areas with greater than one foot of flooding (100yr) as being within the 100 year floodplain. Zone AE
  - **Zone AE** - An area inundated by 1% annual chance flooding, for which BFEs have been determined.
- Areas outside of the 'greater than 1 foot deph areas' would be assigned to Zone X500 or similar. This is the assignment given to nearly all areas within the levees.
  - **Zone X500** - Areas of 500-year flood; areas of 100-year flood with **average depths of less than 1 foot** or with drainage areas less than 1 square mile; and **areas protected by levees from 100-year flood**. An area inundated by 0.2% annual chance flooding.

Comparison of Feasibility Report and LSER Flooded Outlines

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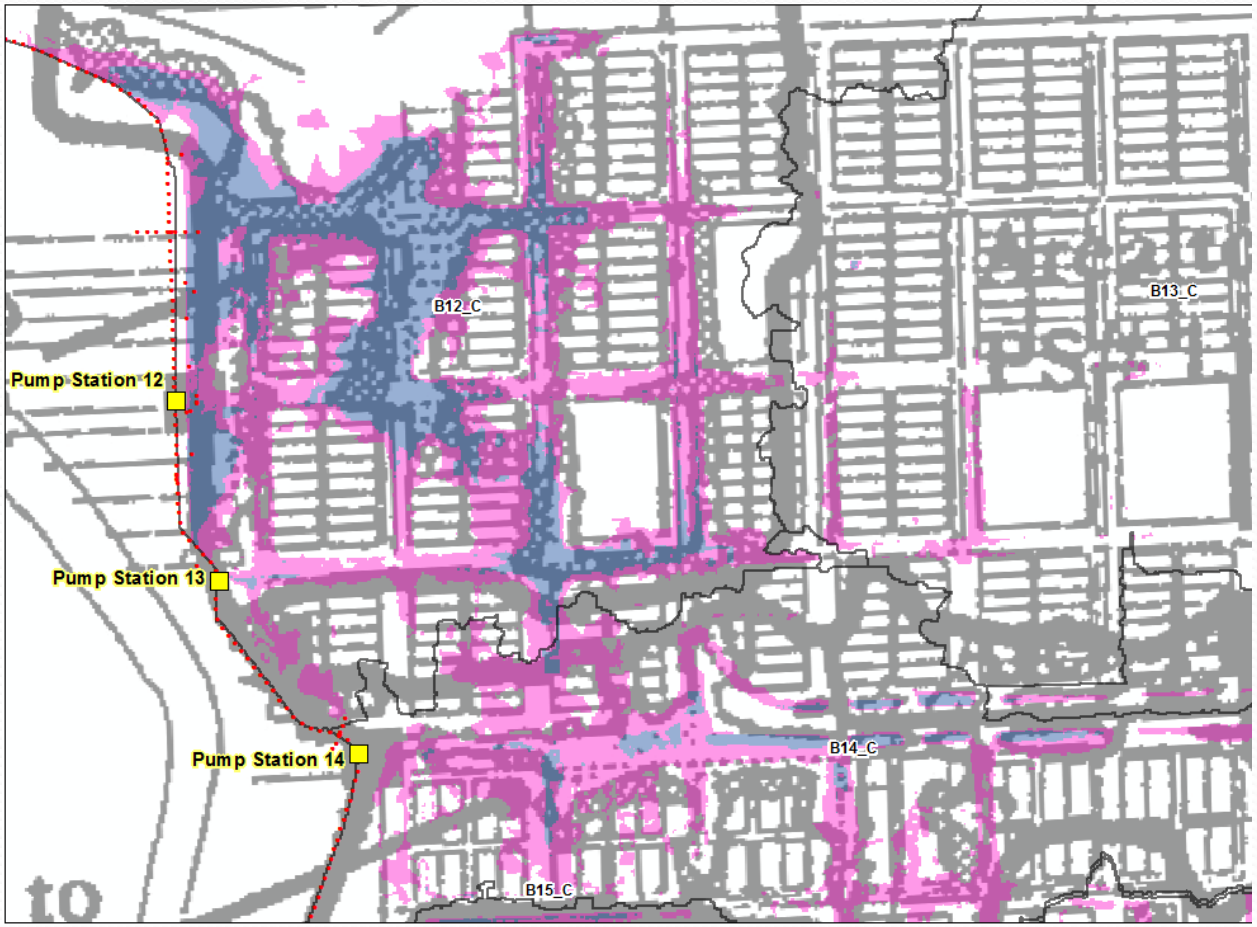
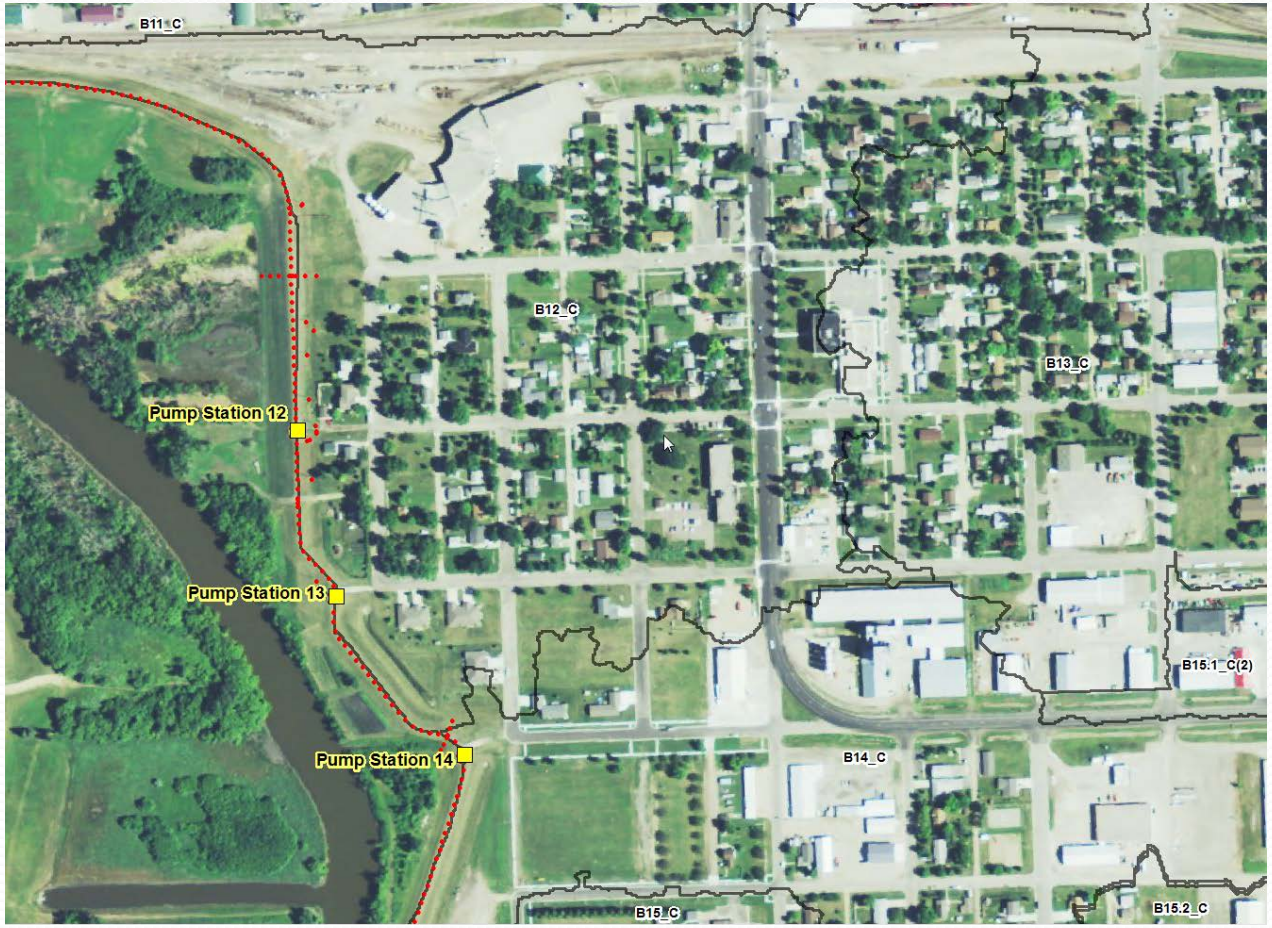
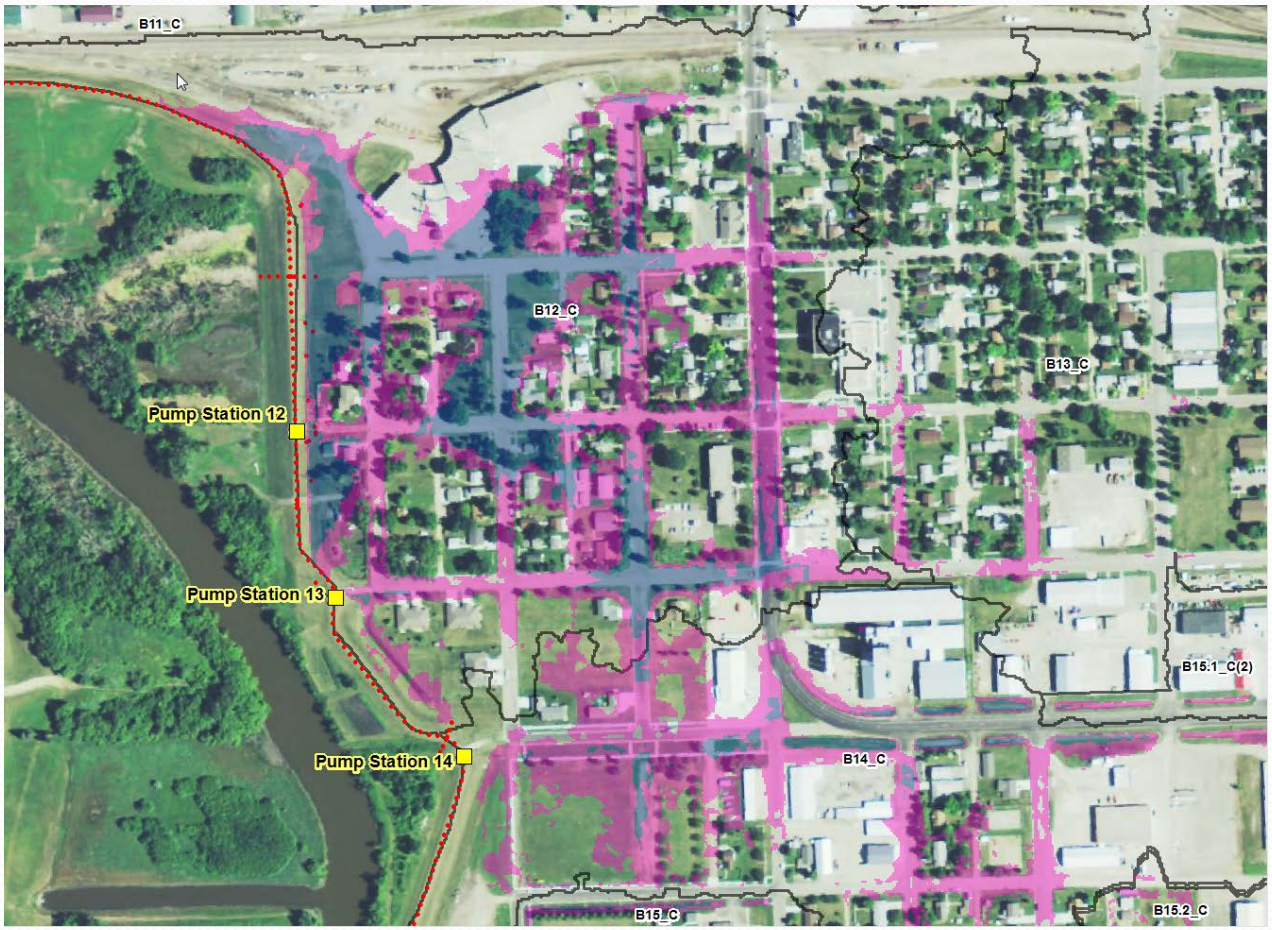


Aerial Photo



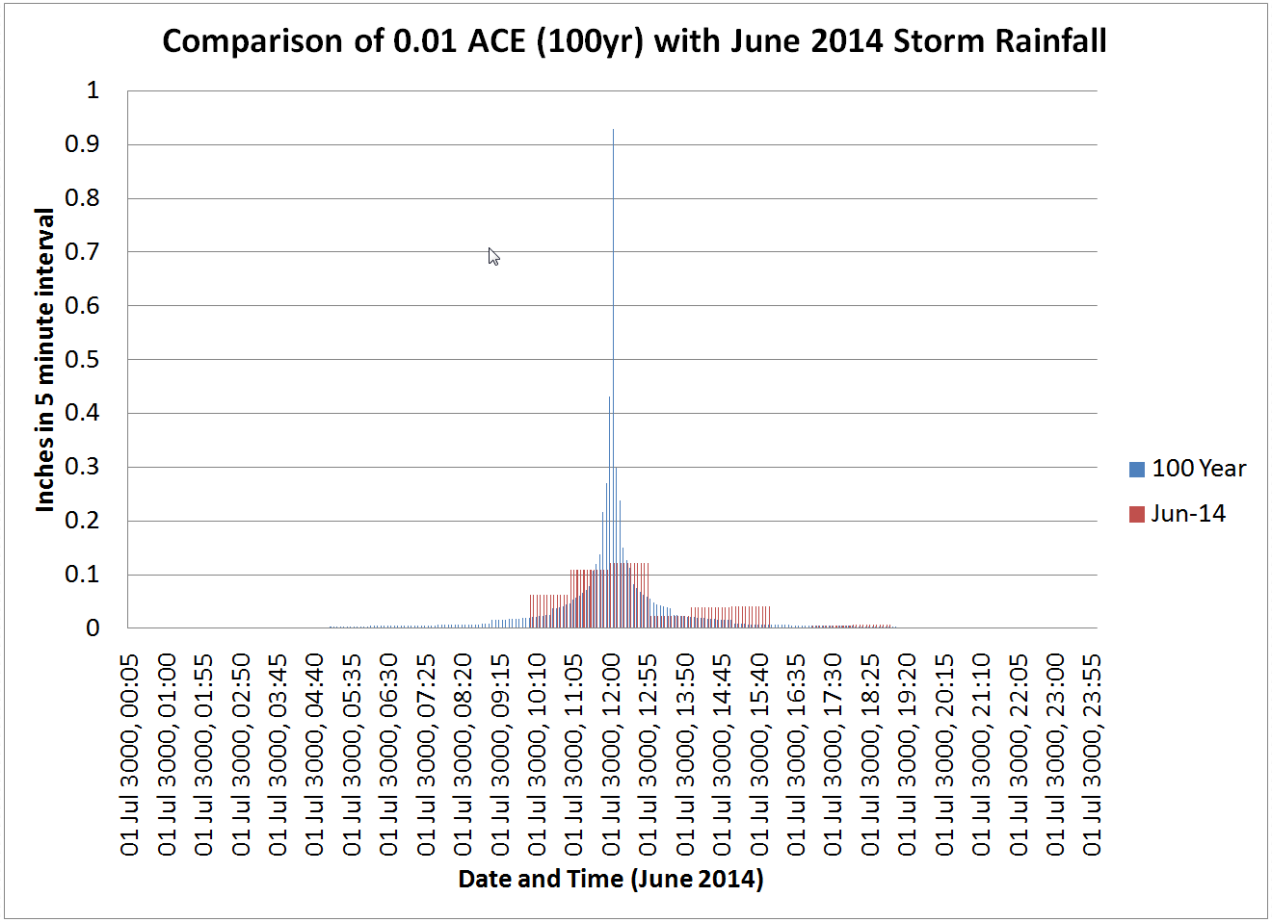
Aerial Photo with Flood Mapping



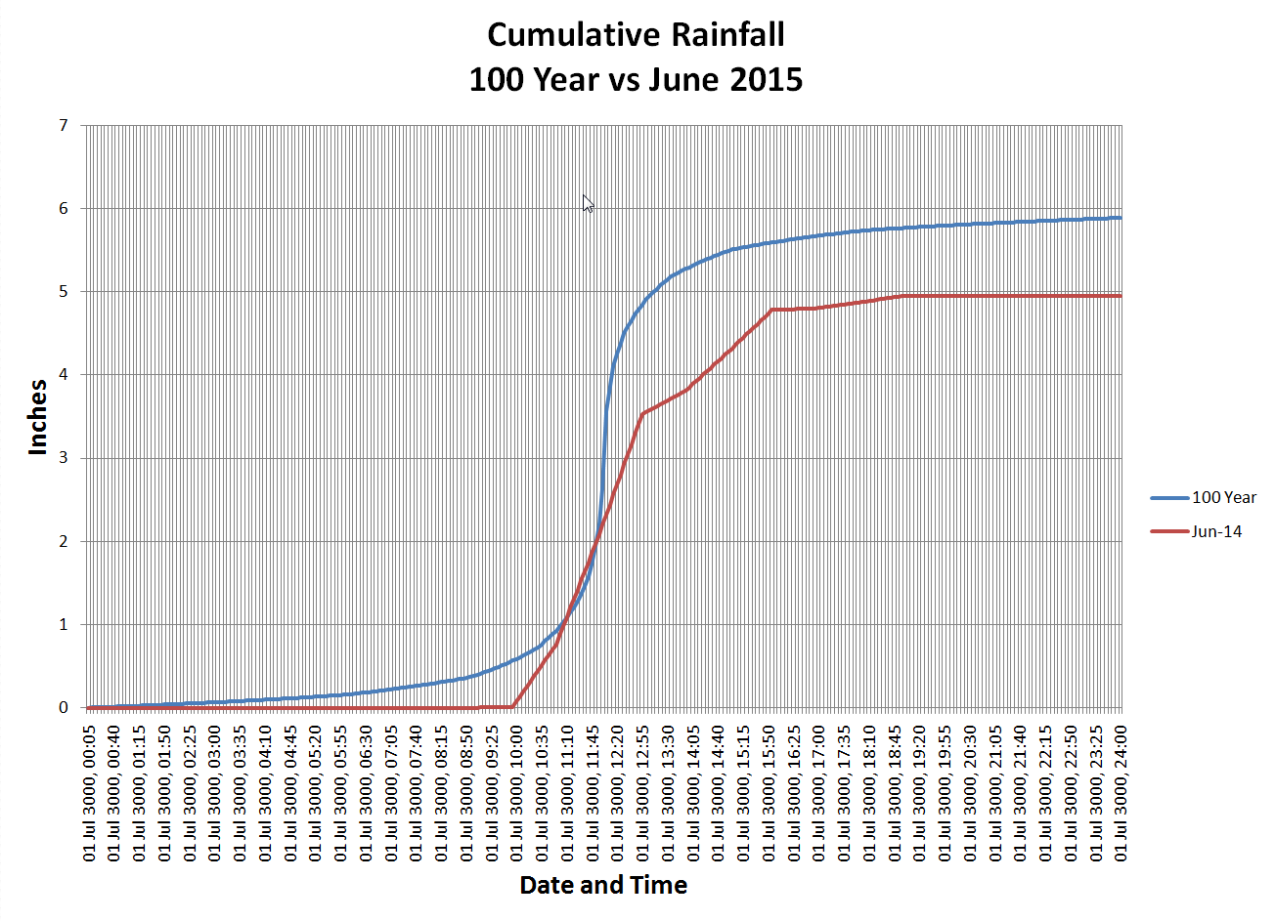
- The increase in stages in these flood prone areas will hopefully be addressed even though FEMA may not specifically map the full 100 year inundation area. More discussion of this will follow.

Overview of Interior Drainage

Precipitation Hyetographs



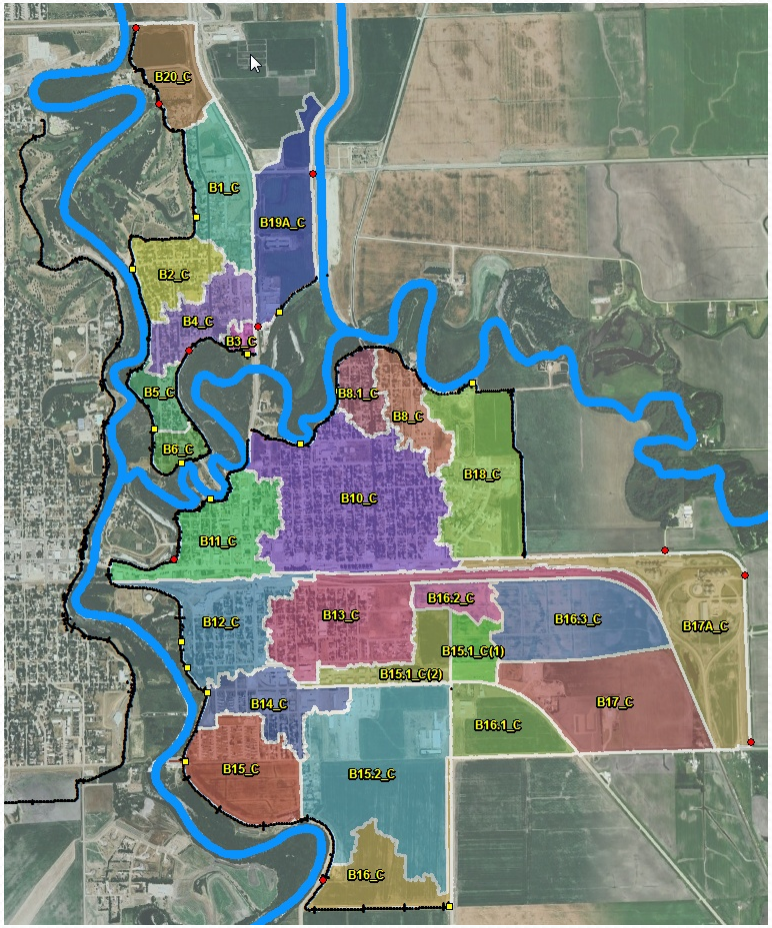
Rainfall – Cumulative Volume



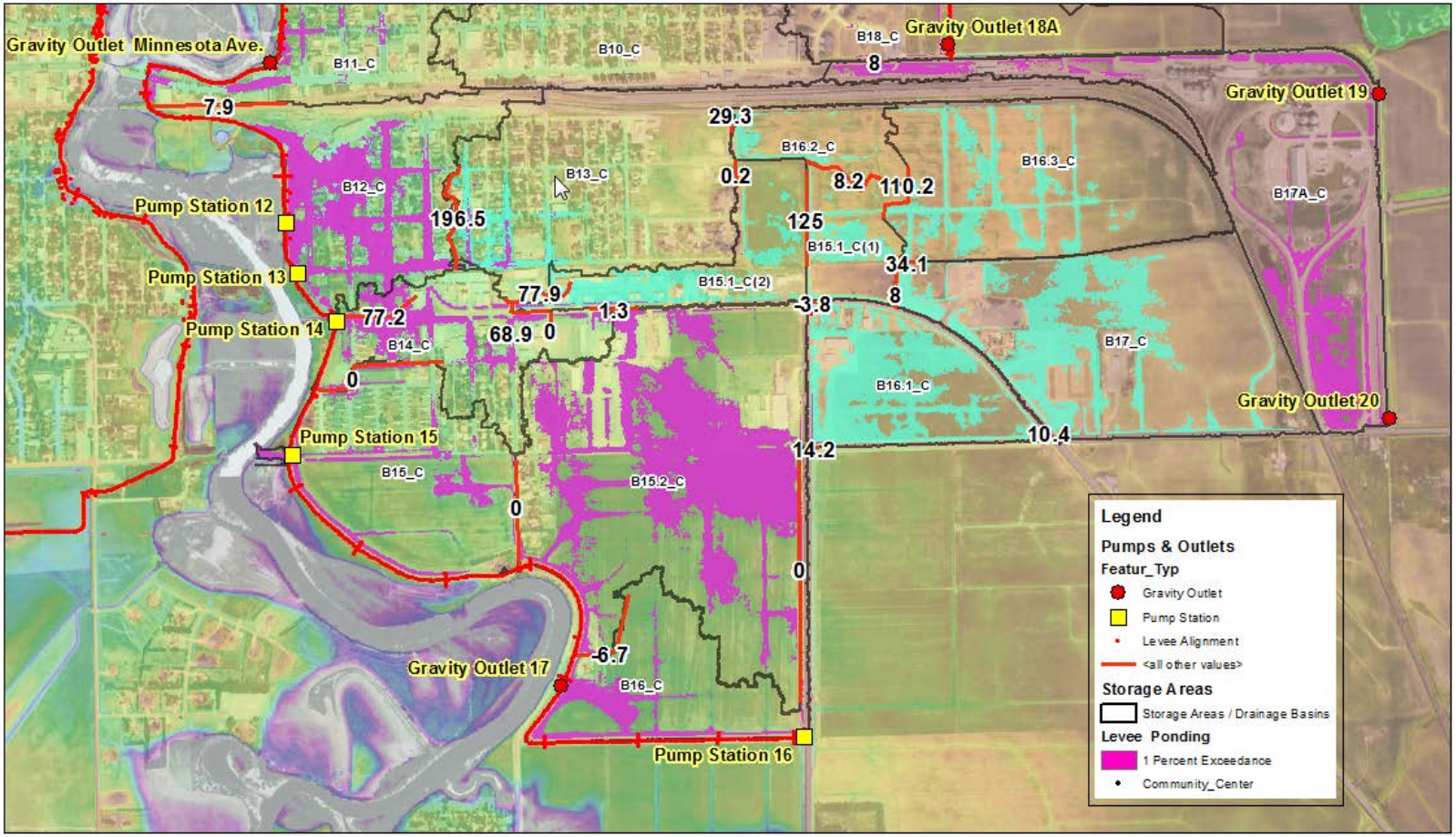
How Runoff is Calculated

- Rainfall for each basin (also called storage area) is used by a program called HEC-HMS to produce flow hydrographs
- These hydrographs are sent to a program called HEC-RAS which routes the water to ponding areas (defined ponding areas or other low areas)
- Upland basins are also routed. Flow from these basins can pass to adjacent basins by culverts (culverts and storm sewers) and by overtopping roadways or high ground areas. This water ultimately makes it's way to levees for discharge to the river.

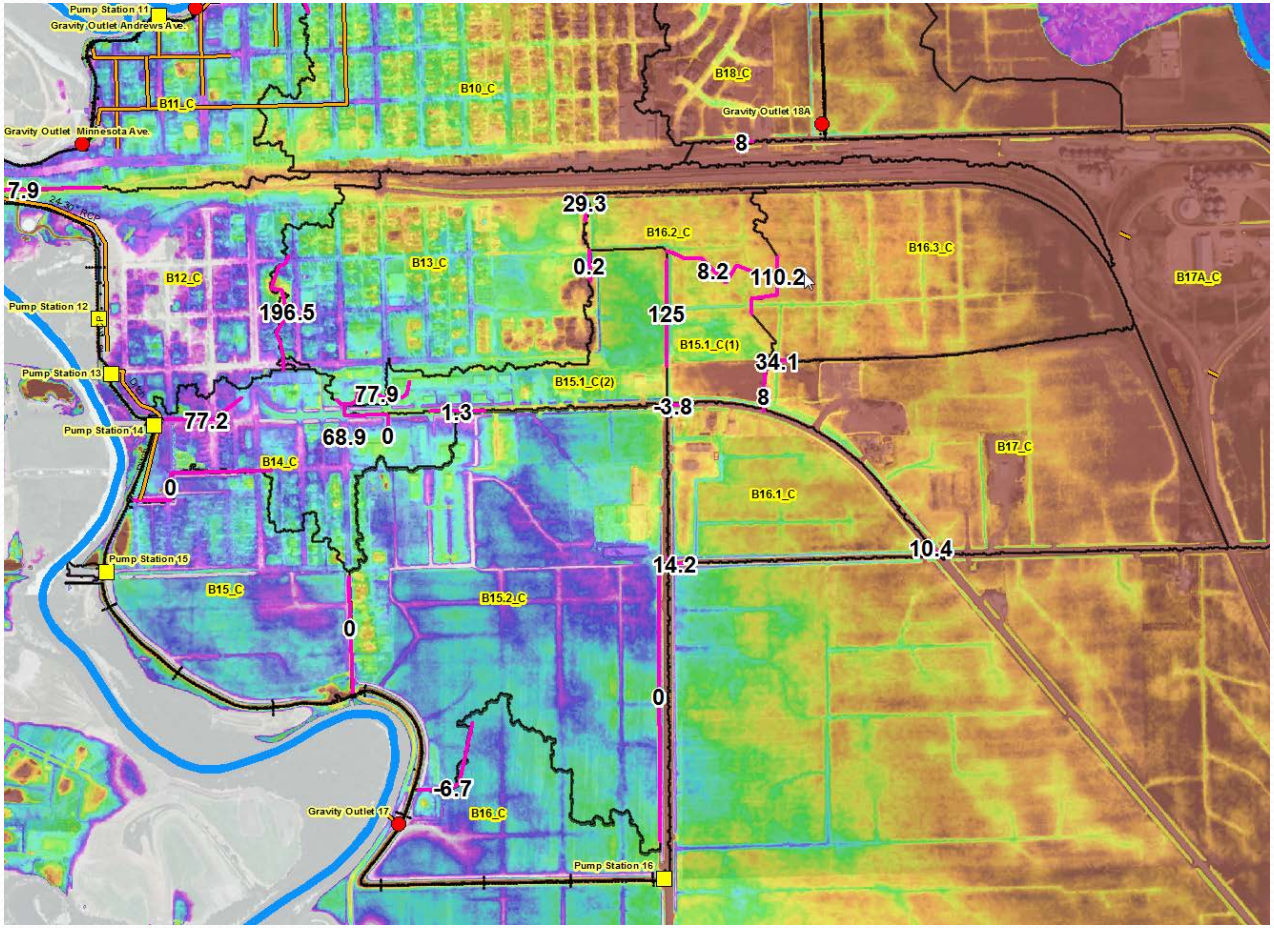
Storage Areas / Basins



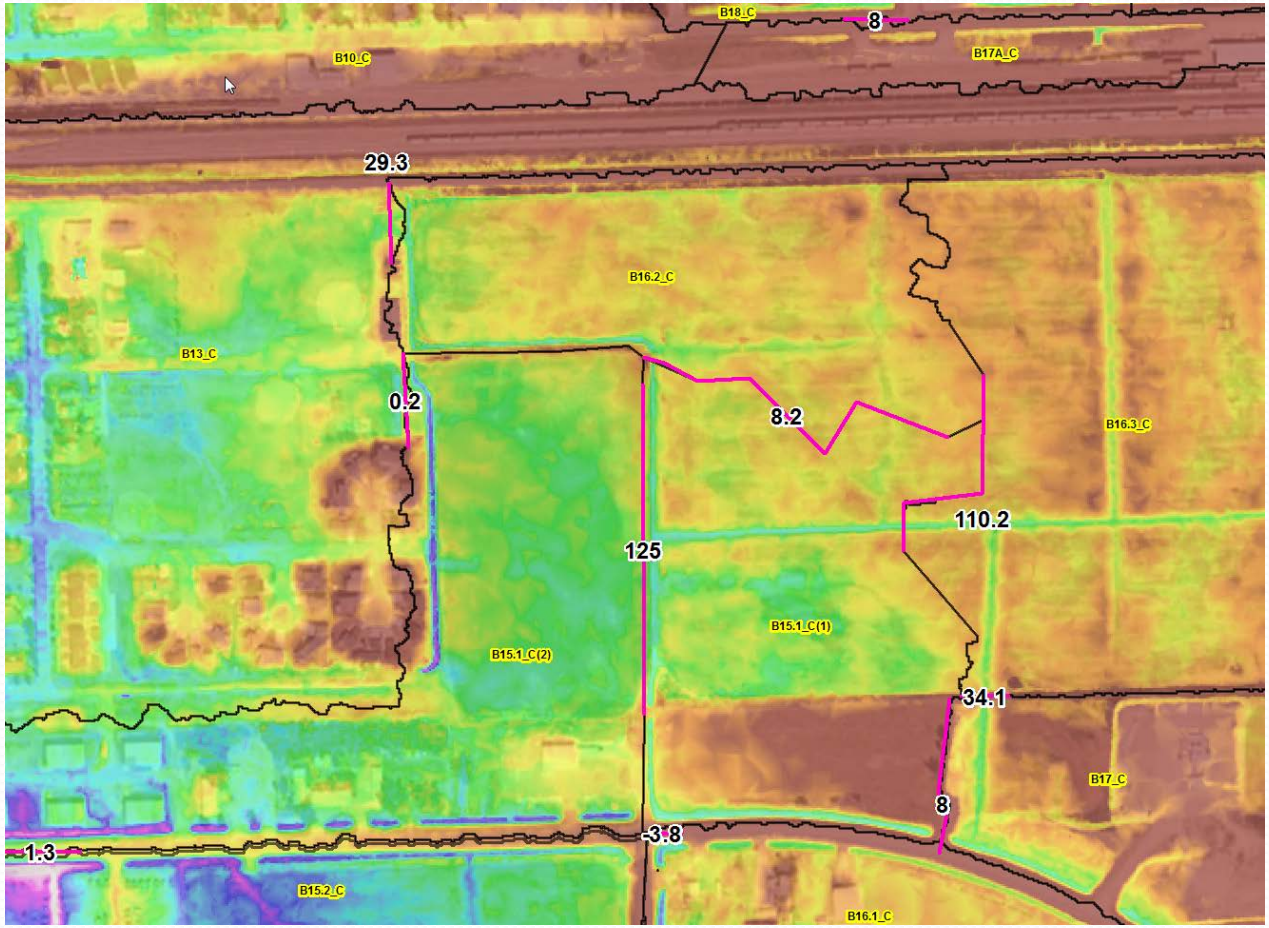
Upland Basins Draining to Area 12



Topography


Pump Station 11
Gravity Outlet Andrews Ave.
Gravity Outlet Minnesota Ave.
B10_C
B11_C
B18_C
Gravity Outlet 18A
8
7.9
29.3
B16.2_C
B16.3_C
B17A_C
B13_C
0.2
8.2
110.2
B12_C
Pump Station 12
196.5
125
B15.1_C(1)
34.1
Pump Station 13
B15.1_C(2)
77.9
8
77.2
1.3
-3.8
Pump Station 14
68.9
0
B17_C
B14_C
0
B16.1_C
10.4
Pump Station 15
14.2
B15_C
B15.2_C
0
0
-6.7
Gravity Outlet 17
B16_C
Pump Station 16

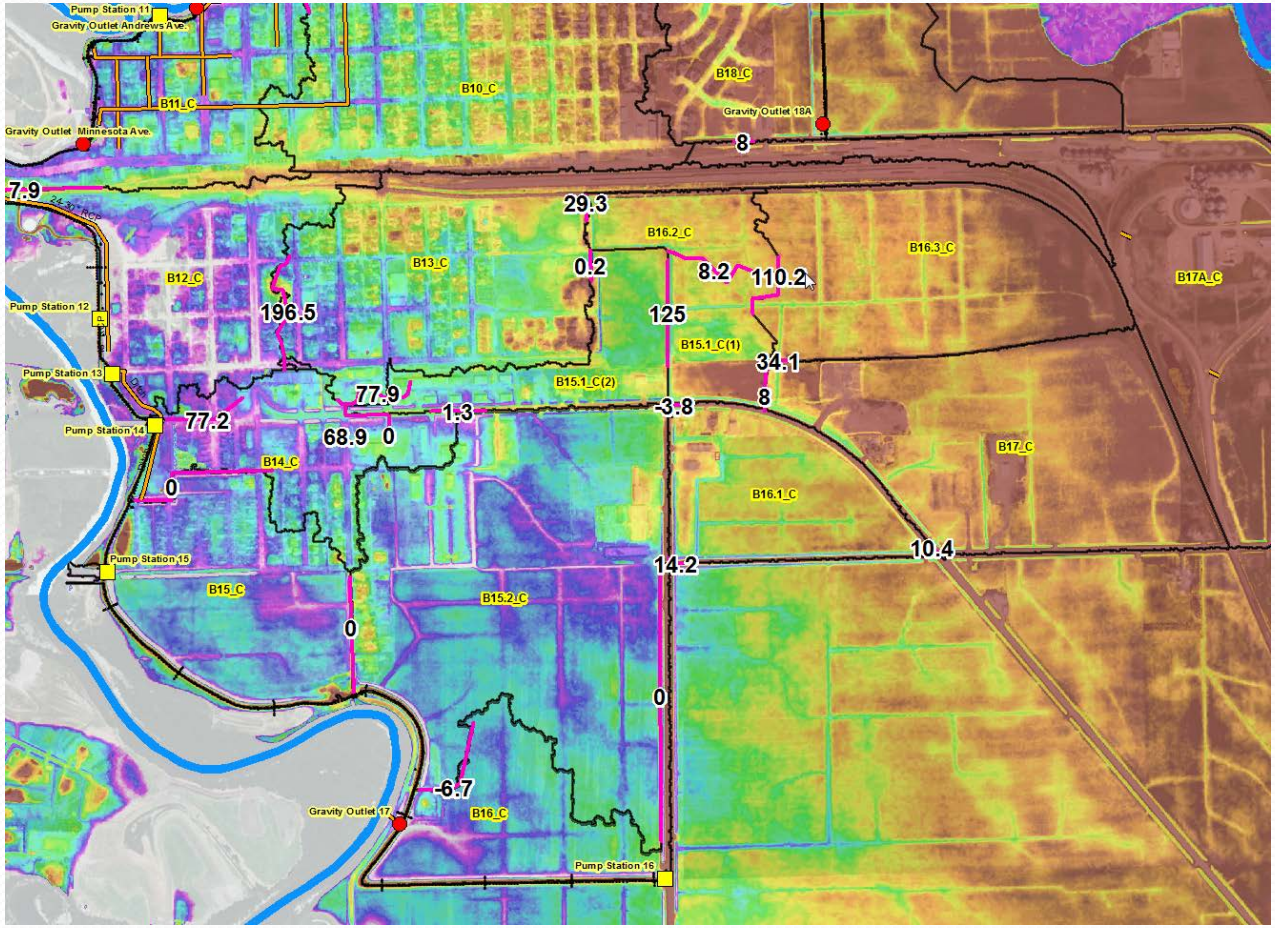
Upland Topography



Primary Difference between Previous and Current Study

- In the Feasibility Report, it appears, most of the drainage from the fields east of Highway 9(if extended north) were not given overland flow capacity. The report mentions 2 culvert outlets but no overland flow from (Feas. Area 16.2). The ponded elevation was high enough for flow overland.
- Pond elevation upstream of Hwy 9
  - Feasibility Report – 965.0 (navd88)
  - LSER – 965.3 (navd88)
  - Breakout Area about 350 feet at elevation 963.6 (navd88)

Topography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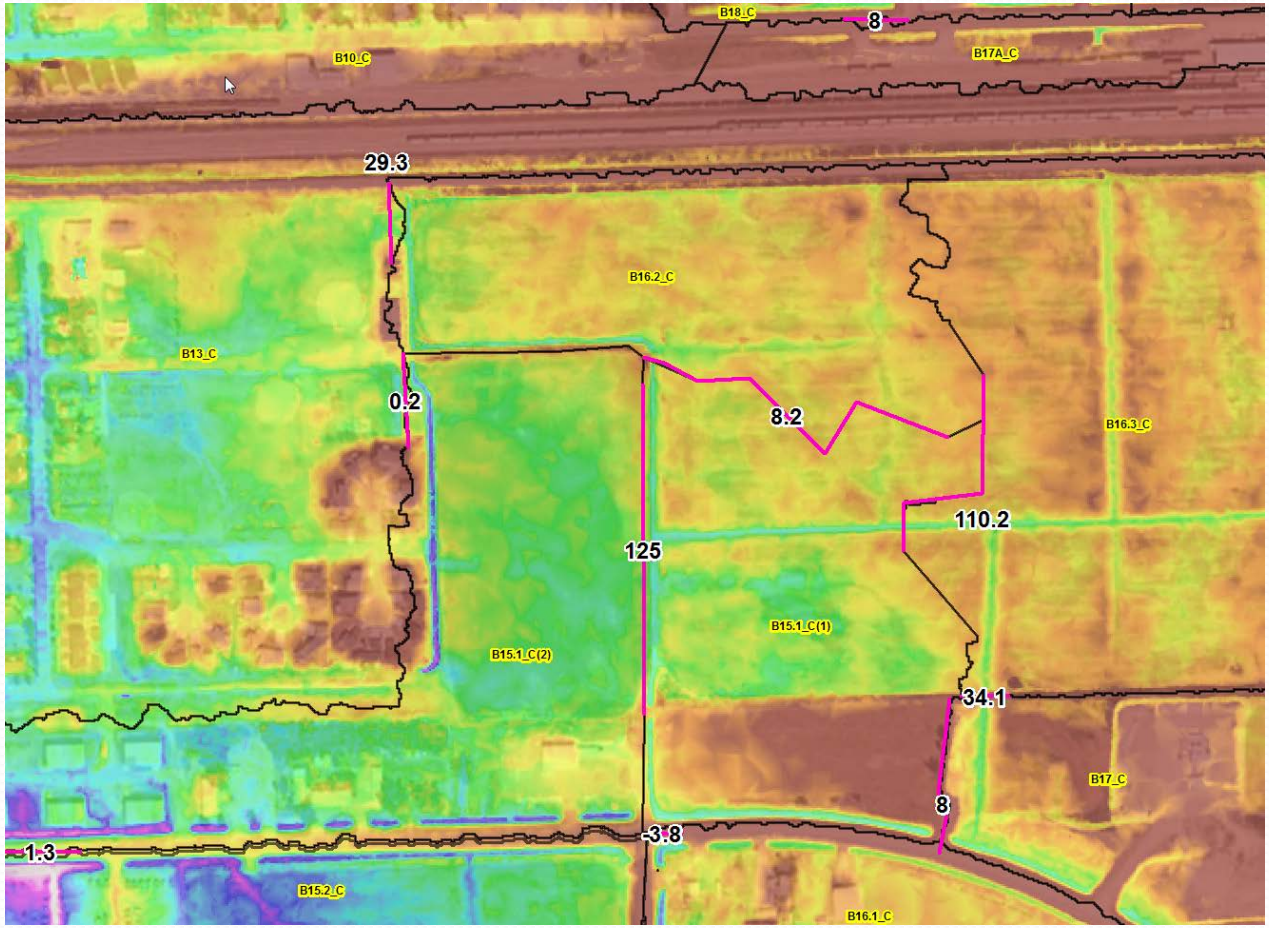
77.2
1.3
Pump Station 14
68.9
0
B17_C
B14_C
0
B16.1_C
10.4
Pump Station 15
14.2
B15_C
B15.2_C
0
0
-6.7
Gravity Outlet 17
B16_C
Pump Station 16

Upland Topography



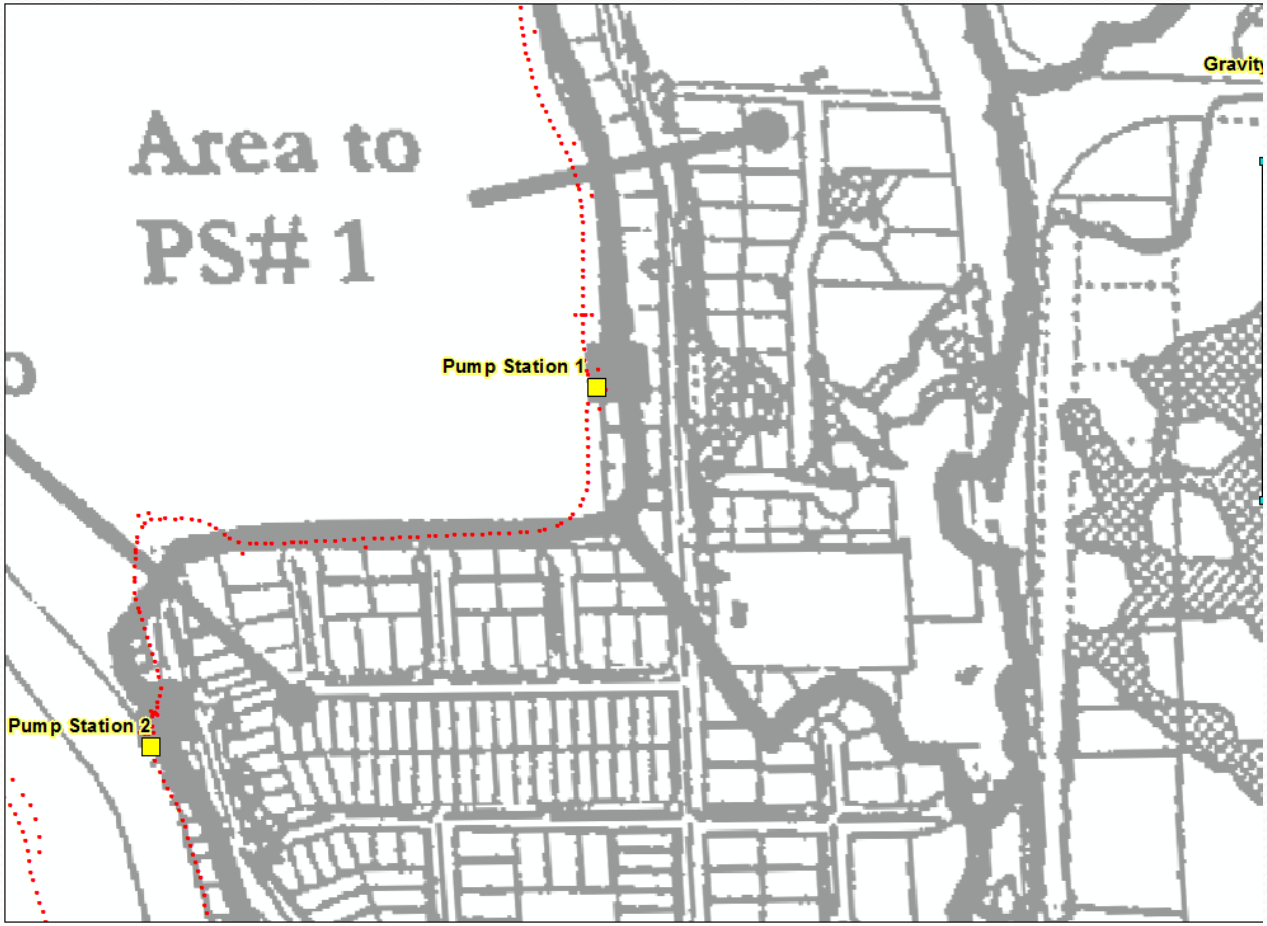
Options

- 1-Block overland flow from the area east of Highway 9 and north of Highway 75

  - This would probably be the easiest and cost effective method.
  - Would drop stages near the roundhouse about a foot.
  - Would increase ponding in fields east of Highway 9
  - Would have added benefit of reducing ponding along north side of Buffalo Avenue.

  2-Alternately another gated culvert under the levee could also be considered reduce stages by about a foot.

Storage Area 1



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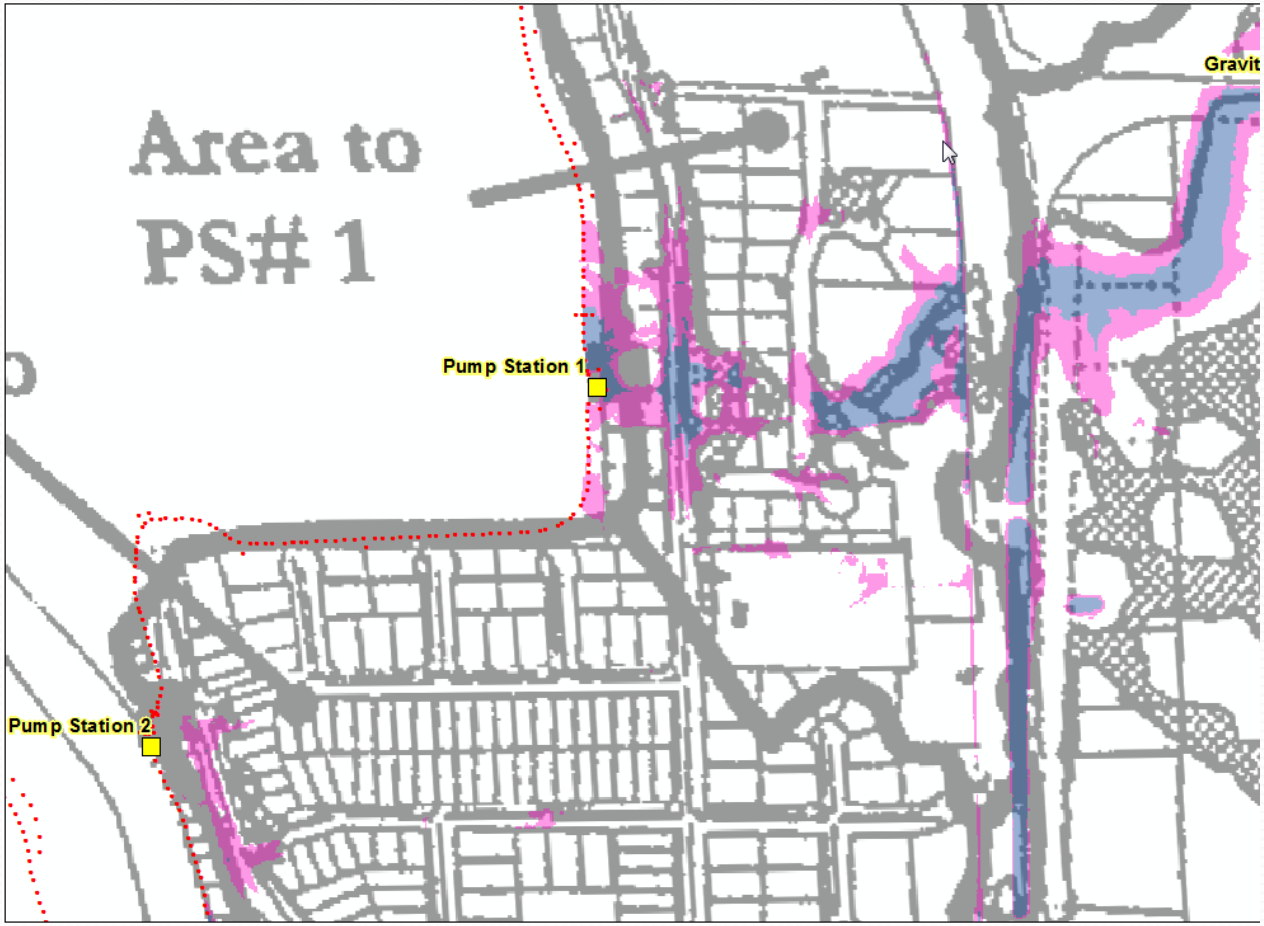
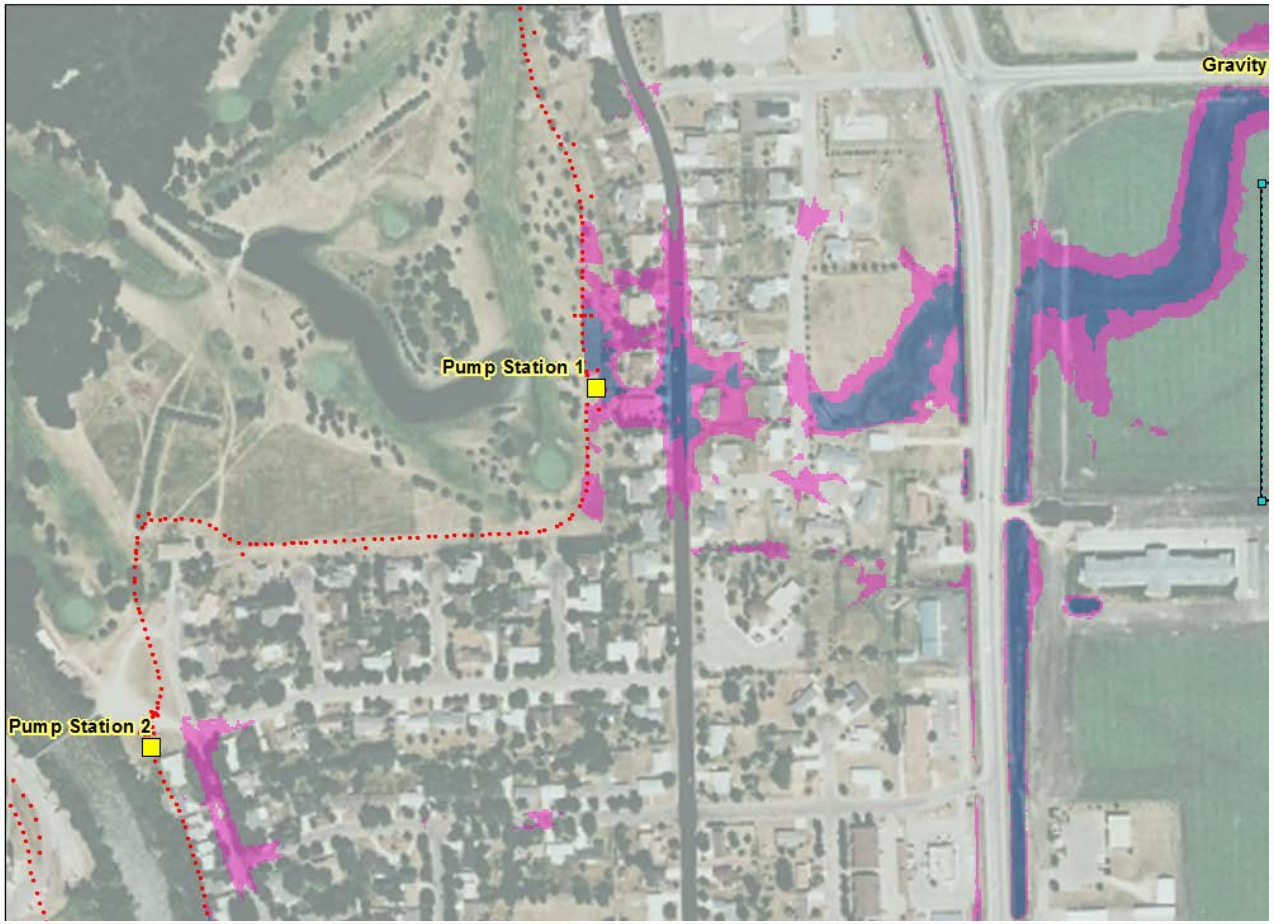
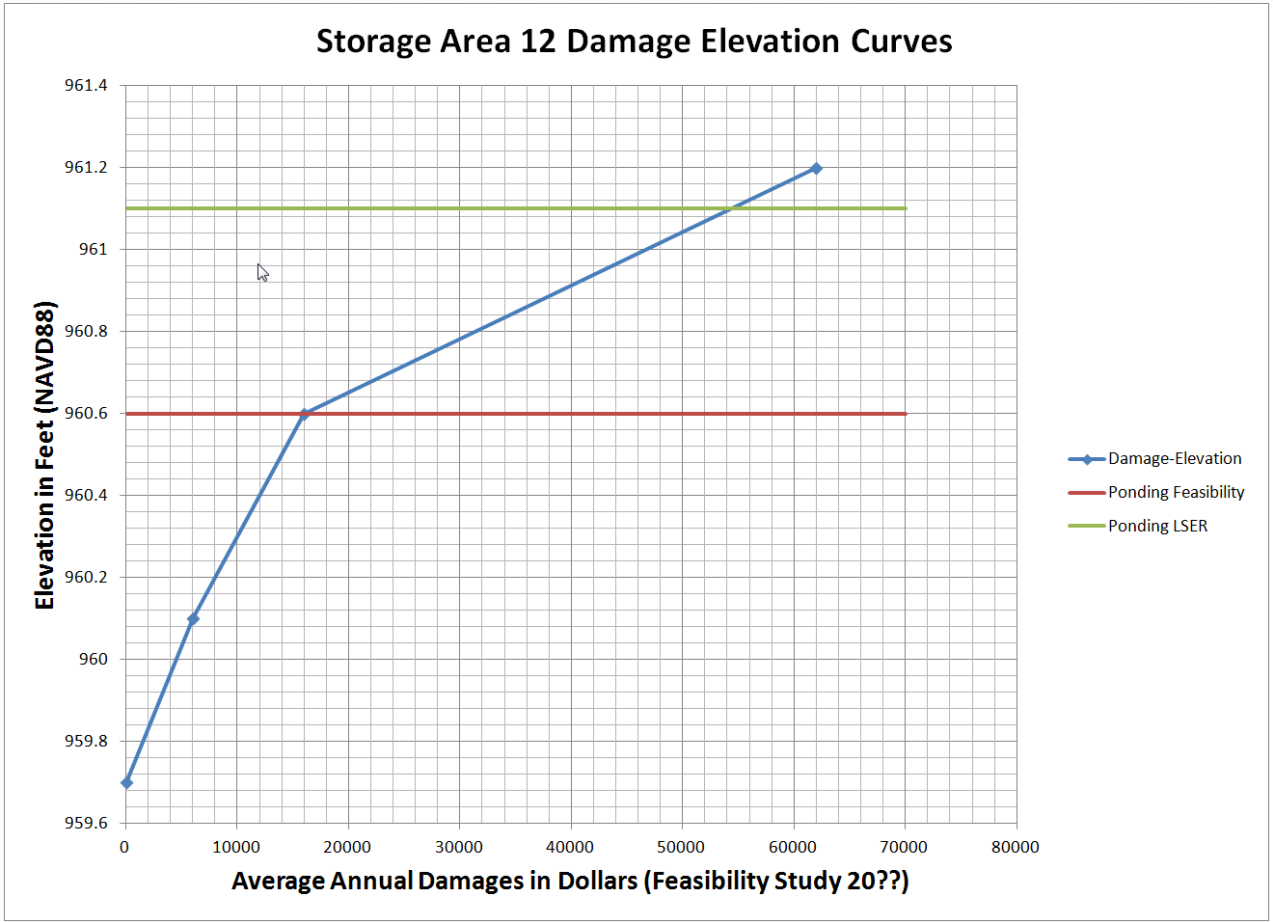


Storage Area 1



Damage Elevation Curve



Gravity and Blocked Gravity

- There were two types of flooding that were studied.
  - Gravity
    - Low River Conditions
    - 100 year rainfall
  - Blocked Gravity
    - High river blocks outlet so Pumps remove water
    - This analysis is based on the largest historical rainfall events that occurred **during high river conditions**
  - Selected Highest of these 100 Year Elevations
    - The higher 100 year stage between gravity and blocked gravity is chosen for each storage area.

Difference in Current and Past Methods of Computing the 100 Year Theoretical Rainfall

- NOAA Bulletin 71 (outdated)
  - Used on former study
  - Rainfall of 5.57 inches
- Atlas 14 (current)
  - Used in this study
  - Rainfall of 5.89 inches
    - This is an **increase of 7.4 percent**